FURTHER OBSERVATIONS OF HOMING TERNS

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Among the most promising recent experiments in the field of bird orientation have been those of Kramer (1952, 1953) and Matthews (1953a, 1953b) in which pigeons and Manx shearwaters released in unfamiliar territory oriented approximately towards home while still within view of the release point. This ability to choose the homeward direction within a few minutes after release seems to be lost when the sun is obscured by clouds. We have recently reported homing experiments in which common terns (*Sterna hirundo*) showed a directional orientation by tending to fly southeast whether the home direction was northeast, south, or southwest (Griffin and Goldsmith, 1955). In these experiments terns from breeding colonies in Massachusetts and Maine were removed to inland areas, released singly, and observed with binoculars for as long as possible from two points about half a mile apart. The simultaneous cross bearings thus obtained allowed us to reconstruct the first few minutes, and the first one to two miles, of the birds' flight. The terns showed a consistent tendency to head approximately southeast when the sun was visible; but with heavy cloud cover they seemed to scatter at random. The southeasterly headings were independent of the home direction, of the wind direction, of the time of day, and (except for bodies of water) of local topography. Even though common terns do not seem to be as skillful navigators as the pigeons studied by Kramer and Matthews, the results are of interest because they add to the growing body of evidence pointing to the sun as an important factor in the orientation of birds.

Matthews (1955) has questioned whether these results do in fact represent a directional tendency on the part of the terns rather than "a crude form of homeward orientation." We therefore wished to extend our previous observations by adding a release point at which home would lie in the opposite direction from southeast. A further reason for this additional experiment was our suggestion that the habit of flying southeast when suddenly released in unfamiliar inland territory might be an advantageous one for terns nesting along the eastern coast of the United States since it would bring them quickly back to the coast. Both considerations indicated an experiment to compare the initial headings of terns nesting in the Great Lakes region with those from the Atlantic coast.

METHODS

The release point selected for this experiment was the airport at Cortland, New York, about midway between Cape Cod and Detroit. This airport is about 12 miles from the nearest lake of any size (Skaneateles), it has little traffic, and the terrain affords a relatively clear view in all directions. Thirty-two terns were captured late on the afternoon of June 8, 1955 at a nesting colony at Metropolitan

Beach, Michigan (15 miles north of Detroit on the shore of Lake St. Clair); on the morning of June 9, nine others were caught on Penikese Island, Massachusetts. Both groups were transported by automobile in boxes covered so as to prevent the birds from observing their surroundings, and all were released on June 10 between 9:30 A.M. and 6:30 P.M. E.S.T., after 24–48 hours in captivity. The methods of capture and handling were the same as in our previous experiments. The terns were again observed through binoculars mounted on tripods equipped with alidades so that bearings could be noted by an assistant. Three observers participated in this experiment, so that the bearings were taken from the three corners of a triangle with legs approximately 0.4, 0.6, and 0.8 mile in length—the eastern corner being the release point. The terns from the two colonies were released in an irregular sequence, and each bird was set free only after the previous one had been lost from view by all three observers. No attempt was made to check the homing performance by subsequent observations of the nests, since earlier studies had shown that the homing times of terns are too long to contribute any useful information about the route flown (Griffin, 1943).

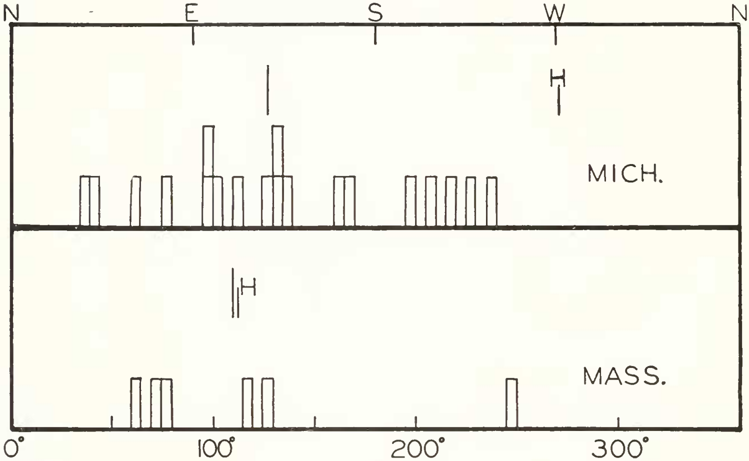

FIGURE 1. Graphic comparison of the initial headings of 25 common terns from colonies in Massachusetts and Michigan released the same day at Cortland, New York. Homeward direction is indicated by an "H", mean heading of each group by an unmarked vertical line.

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Observations of Initial Headings

All of the terns were released under clear or partly cloudy skies when the position of the sun was evident, though the sun itself was sometimes temporarily hidden behind a cumulus cloud. The day was warm, and there were numerous updrafts on which the terns tended to climb and soar. We thus lost sight of some birds at heights of several hundred feet above the ground before they had indicated a definite heading away from the release point. Unknown to us at the time the releases were begun, there was also a small pond 1.2 miles to the southwest of the release point which attracted some of the terns.

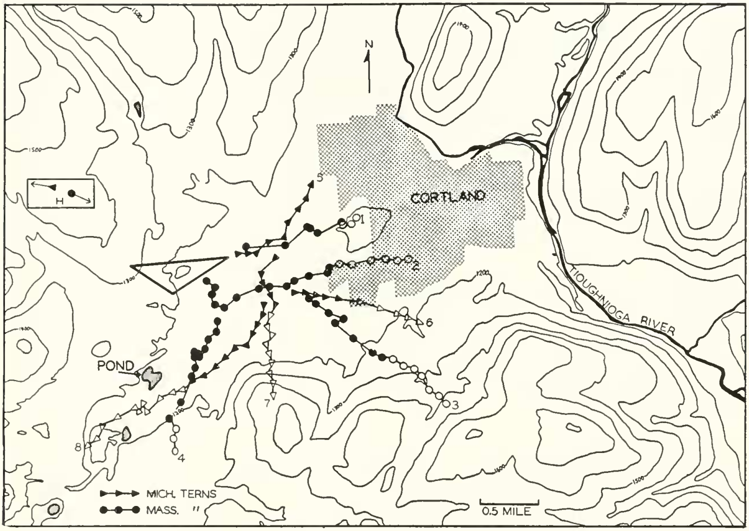

Figure 2. Sample flight paths of eight common terns. Solid circles and triangles stand for crossbearings, open circles and triangles for single bearings. Directions of the home colonies are shown by the arrows in the box (H) at the left. Positions of the observers are represented by the corners of the large triangle. Contour interval is 100 feet. See the text for a discussion.

The results are summarized in Figure 1, in which the points of the compass are "unrolled" on the horizontal axis; each bird is represented by a vertical rectangle. Only those birds are included that gave a distinct heading; the nine attracted to the pond and the seven lost while still circling less than 3000 feet from the release point have been omitted. Home direction is indicated by a capital "H" and a vertical line, the mean heading by an unmarked vertical line. The graph shows that the birds, from the Michigan colony at least, tended to head in a southeasterly direction. The average of the 19 Michigan terns was 139° (40–237°), while the average heading for the 6 Massachusetts terns was 93° (64–130°). In previous experiments with terns from coastal colonies the average initial headings were 140°, 142°, 142°, and 149° when the home directions were 115°, 115°, 44°, and 211°, respectively. The Michigan terns released at Cortland thus showed nearly the same average heading as the coastal terns studied in previous seasons. The more easterly headings of the Massachusetts terns released at Cortland have no obvious explanation, but there were too few birds involved to render the difference between the two groups significant. While the individual headings varied more widely at Cortland than in our previous experiments, the distribution is by no means random, nor do the average headings differ significantly from our previous results.

Figure 2 is a selection of eight sample flight paths plotted from the simultaneous cross bearings and superimposed on a topographic map of the area. The portions of the lines marked by open circles and triangles represent parts of the path for which only one observer had the bird in view and are extrapolations of the earlier part of the flight (solid circles and triangles) for which there were cross bearings. For clarity, some of the first cross bearings from each flight path have been omitted. It is from such flight paths as these that Figure 1 was constructed. Birds numbered 5, 6, 7, and 8 (triangles) are from the Michigan colony, which lies about 335 miles to the west. Numbers 5 and 8 represent the extremes of the distribution; numbers 6 and 7, as well as the other fifteen from Figure 1, lie between these two. Similarly numbers 1, 2, 3, and 4 (circles) are terns from the Massachusetts colony, about 290 miles to the ESE, and numbers 1 and 4 are the extremes of the Massachusetts distribution. This figure shows that the topography had no obvious influence, although certain of the birds (not shown in Figure 2) were attracted to a pond to the southwest. For example, note that number 7 flew over a hill which rises to over 300 feet above the release point while number 2 flew over the city of Cortland. While the birds could certainly see terrain which lies beyond the boundaries of this map, reference to a smaller scale map shows no topographical features which explain the southeast headings.

Discussion

This experiment demonstrates that the tendency to fly in a southeasterly direction when first released in unknown, inland territory is not confined to common terns nesting along the coast; it was equally evident in terns from a colony in the Great Lakes area even though for these birds home lay almost due west. The same directional tendency has thus been observed when the home direction was northeast, east-southeast, south, southwest and west. Austin (1953), who has analyzed the migration route of this species on the basis of banding returns, has shown that both the Great Lakes and New England tern populations have a pronounced southeast component in the fall migration route. But whether this is relevant in the case of birds removed from their nesting grounds during the breeding season is open to question.

Arnould-Taylor and Malewski (1955) have recently suggested that topographic cues have been responsible for most of the results obtained by observing initial headings of homing birds. That topography may be the dominating influence under certain conditions has been firmly established; for example, Griffin (1952) reported that in a series of airplane observations of homing pigeons, certain of the birds followed roads, railroads, and lake shores. We have pointed out that in these experiments with common terns, local bodies of water attract many birds; but, when precautions are taken to avoid release points with ponds in the vicinity, the terns tend to fly approximately southeast. Because it is so difficult to explain such observations on the basis of topographic cues, it is perhaps too soon to abandon all thought that birds employ some more refined method of navigation.

Summary

1. Our observations of the initial flight directions of common terns released in unfamiliar territory have been extended to include birds from the Great Lakes region as well as from the New England coast. When terns from both populations were released on the same day at Cortland, New York, both groups showed a tendency to head approximately southeast.

2. The first mile or two of the terns' flight paths were plotted on a topographic map of the area. Aside from the fact that a small pond attracted some of the birds, topography did not offer any apparent explanation of their headings, and a few persisted on a southeasterly course over moderately high hills.

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